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(54) IMPROVEMENTS IN AND RELATING TO MOTOR VEHICLE SUSPENSIONS

(71) I, WILLIAM LUMSDEN HILL, a British Subject, of Nower Hayes, Tyrrells Wood, Leatherhead, Surrey, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a suspension for a motor vehicle, and is particularly applicable to a pair of driven non-steerable wheels such as the rear wheels of a conventional rear-wheel drive motor car or motor lorry.

When a vehicle is travelling over a smooth surface, its body should preferably have a low ground clearance because this gives the vehicle a low centre of gravity. However, when the vehicle is travelling over an uneven surface the ground clearance should be higher to prevent the underside of the vehicle from fouling irregularities, and the suspension should be soft in order to improve the ride. Thus it would be advantageous for vehicles to have a variable ground clearance and a suspension of variable stiffness which could be adjusted to suit different surfaces.

According to the invention, a suspension for connecting a vehicle chassis or bodyshell to a pair of road wheels comprises a pair of suspension arms each attached at one end to one of the said wheels, and at the other end to a torsion bar which is adapted to be clamped to the chassis or bodyshell at a variable point along its length, the angle of each suspension arm to the longitudinal axis of the vehicle when the suspension is in equilibrium being variable.

The angle of each suspension arm to the vehicle axis may be varied by rotating its longitudinal axis. There are preferably two torsion bars, one associated with each suspension arm.

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According to another feature of the invention, the or each torsion bar may be attached by a lever to a member adapted to be raised or lowered relative to the chassis or bodyshell, thereby angularly displacing the torsion bar relative to the chassis or bodyshell.

Each of the pair of road wheels may be coupled to one of a pair of drive shafts adapted to be driven from a propeller shaft, the total length of the two drive shafts being greater than the distance between the wheels. In this case, each drive shaft preferably extends from its associated wheel to a point beyond the longitudinal median plane of the vehicle, each drive shaft being connected at this point to a gear assembly connected to a shaft adapted to be driven from the propeller shaft through a pair of bevel gears and differential gearing.

The drive shafts are each provided with at least one universal joint and one splined joint to accommodate vertical movement of the wheels relative to the chassis or bodyshell. One advantage of this arrangement of the drive shafts is that the angle through which the shafts have to move to accommodate vertical wheel movements is less than with a conventional drive shaft arrangement.

The propeller shaft may be geared to the drive shafts via two bevel gears having their axes not at right angles so that the drive shafts are not perpendicular to the propeller shaft.

One embodiment of the invention will now be described by way of example and with reference to the drawings.

Figure 1 shows a plan view of an assembly according to the invention, and Figures 2 and 3 show side elevations of parts of a device for adjusting the stiffness of the springing in the suspension.

In Figure 1 the road wheels 68 and 69 are driven from a propeller shaft 30 which is

connected via a universal joint 13 to a final drive assembly 12. The final drive assembly consists of differential gearing and two bevel gears (not shown), the axes of which are not perpendicular. The final drive assembly is connected via shafts inside casings 66 and 67 to gear assemblies 60 and 61, which contain helical gears 4, 5 and 16, 17. Gear 17 is mounted below gear 16 and gear 5 below gear 4 and all are mounted in thrust bearings 6, 7, 8, 9, 18, 19, 20 and 21.

The gears 5 and 17 are connected, via universal joints 10 and 15 and splined joints 11 and 14, to drive shafts 2 and 64 which are in turn connected to the wheels via universal joints 3 and 22. Drive shaft 2 passes beneath the final drive assembly 12 and so cannot foul it.

The wheels are connected by suspension arms 1 and 23 to torsion bars 59 and 31, which are connected via suspension members 46 and 48 and 28 and 27, to a channel 24, the suspension arms are connected to the chassis or bodyshell of the vehicle by bearings 58 and 39 having bearing pins 56, 57 and 40, 41. The suspension members 46 and 48 and 28 and 27 are slidable on the torsion bars 59 and 31 and may be clamped to the bars by operation of handles 47 and 29 and locking arms 33 and 70 respectively. The effective lengths of the torsion bars may thus be adjusted by clamping the suspension members at different positions along the bars. The handles 47 and 29 are provided for releasing torque between members 46 and 48 and 28 and 27 respectively.

The hand wheels 44 and 71 are connected to threadedd rods 45 which pass through the members 48 and 27 so that when these handwheels are turned, the suspension members are caused to slide along the torsion bars.

Handles 50 and 25 are provided for raising or lowering the channel 24 relative to the chassis or bodyshell. These handles are connected to threaded bars which pass through the channel (see figure 2) their lower ends being mounted in joints connected to the chassis (not shown).

The threaded bar 45 passes through a curved slot in plate 53 (see figure 3) which is attached to the chassis or bodyshell, the slot being necessary to allow the suspension to be raised or lowered.

In operation, the stiffness of the suspension is altered by first jacking the vehicle up to take the load off the suspension and wheels. Locking arm 33 is turned to unlock handle 47, and handle 47 is then turned to release the torque between 46 and 48 and hence unlock them from the torsion bar 59. The wheel 44 may now be turned to slide the suspension members along the torsion bar to the desired position. Handle 47 is then tightened to take up any play between 48 and 59, and then the locking arm 33 is turned to lock the suspension in the new position.

The ground clearance is adjusted by jacking the vehicle up and by turning the handle 50 which raises or lowers channel 24, which in turn alters the angle of the arm 48 which thus alters the angle of the suspension arm 1. In both of these operations similar procedures are carried out to adjust the other half of the suspension, shown in the lower part of Figure 1. When the arms 1 and 23 move downwards, the road wheels 68 and 69 are carried downwards with them. The movement is accommodated in the transmission at the universal joints 3, 15, 10 and 22, and at the splined joints 11 and 14. In addition the propeller shaft may be lowered by tilting the final drive assembly so that the centre line of the universal joint 13 is lower than that of the shafts inside casings 66 and 67.

WHAT I CLAIM IS:—

1. A suspension for connecting a vehicle chassis or bodyshell to a pair of road wheels, comprising a pair of suspension arms each attached at one end to one of the said wheels, and at the other end to a torsion bar having associated therewith means whereby the torsion bar can be fixed relative to the chassis or bodyshell at a variable point along its length, and means whereby the angle of each suspension arm to the horizontal when the suspension is in equilibrium may be varied.

2. A suspension according to claim 1, wherein in operation the angle of each suspension arm can be varied by rotating its associated torsion bar about its longitudinal axis.

3. A suspension according to claim 2, including two torsion bars, each associated with one of the suspension arms.

4. A suspension according to either of claims 2 or 3 wherein the or each torsion bar is attached by a lever to a member adapted to be raised or lowered relative to the chassis or bodyshell, thereby angularly displacing the torsion bar relative to the chassis or bodyshell.

5. A suspension according to any preceding claim wherein each of the said wheels is coupled to one of a pair of drive shafts adapted to be driven from a propeller shaft the total length of the two drive shafts being greater than the distance between the wheels.

6. A suspension according to claim 5, wherein each drive shaft extends from its associated wheel to a point beyond the longitudinal median plane of the vehicle, each drive shaft being connected at this point to a gear assembly connected to a shaft adapted to be driven from the pro-

peller shaft through a pair of bevel gears and differential gearing.

7. A suspension according to claim 5 or to claim 6 wherein each drive shaft is provided with at least one universal joint and one splined joint.

8. A suspension according to claim 6 wherein the axes of the bevel gears are not at right angles, so that the shafts are not perpendicular to the propeller shaft.

9. A suspension substantially as hereinbefore described with reference to the accompanying drawings.

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I SHEET
This drawing is a reproduction of the Original on a reduced scale.

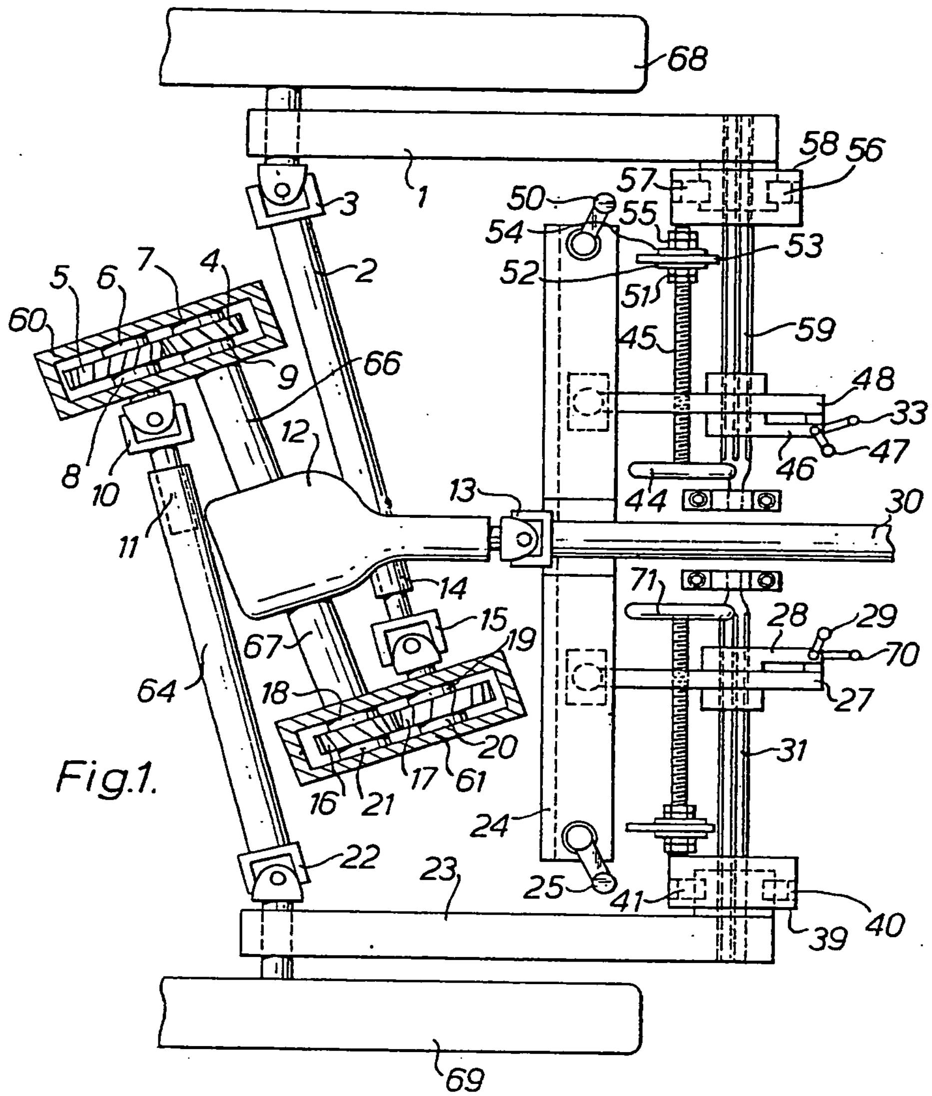

Fig.1.

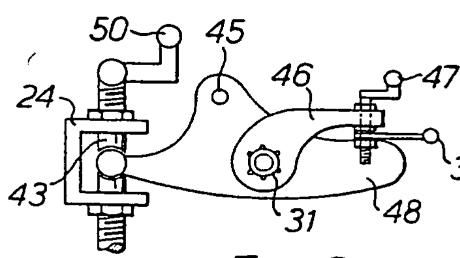

Fig.2

Fig.3.